CLAIMS

1. In the transcoding of video streams, a method for adaptive rate control, the method comprising:

accepting frames of an input MPEG encoded video stream;

decoding the video stream;

determining video stream complexity;

for each frame, calculating an output video stream quantization parameter (*Qo*) responsive to determined video stream complexity; and,

encoding the output video stream into a protocol using *Qo*.

2. The method of claim 1 further comprising:

accepting a target bit rate ratio (r) for transcoding the video stream that is equal to the ratio of the target output video stream number of bits per frame (*No*), to the input video stream number of bits per frame (*Ni*) as follows:

$r = No/Ni$; and,

wherein calculating *Qo* responsive to determined video stream complexity includes calculating *Qo* in response to the value of r.

3. The method of claim 2 wherein determining the video stream complexity includes calculating an average input video stream quantization factor (*Qi*) for each frame; and,

wherein calculating *Qo* responsive to the determined video stream complexity includes initially calculating *Qo* as follows:

$Qo = Qi/r$.

4. The method of claim 3 wherein accepting frames of an input MPEG encoded video stream includes accepting frames with a plurality of slices; and,

wherein calculating Qi for each frame includes calculating the quantization parameter by averaging the Qi values for each slice in a frame.

5. The method of claim 3 wherein accepting an input MPEG encoded video stream includes accepting intra (I), predictive (P), and bi-directionally predictive (B) picture types; and,

wherein determining the video stream complexity of the input MPEG encoded video stream includes:

independently determining the complexities of the I, P, and B picture types in the input video stream; and,

independently determining the complexities of the I, P, and B picture types in the output video stream.

6. The method of claim 3 wherein determining the video stream complexity includes determining a complexity ratio: of an accumulated complexity in the output video stream, to an accumulated complexity in the input video stream.

7. The method of claim 6 wherein the accumulated complexity in the input video stream is the product of *Qi* times *Ni*, accumulated over a plurality of frames; and,

wherein the accumulated complexity of the output video stream is the product of *Qo* times *No*, accumulated over the plurality of frames.

8. The method of claim 7 wherein determining the video stream complexity includes expressing the complexity ratio (α_k) as follows:

$$\alpha_k = \frac{\sum_{j=0}^{k-1}(Q_{o,j} \cdot N_{o,j})}{\sum_{j=0}^{k-1}(Q_{i,j} \cdot N_{i,j})};$$

wherein *j* equals the plurality of frames; and,

wherein *k* is the current frame.

9. The method of claim 8 wherein calculating *Qo* includes calculating *Qo*, for each frame, as follows:

$$Qo = (\alpha_k \cdot Qi)/r.$$

10. The method of claim 9 further comprising:

determining an actual bit rate ratio (r') for transcoding the video stream as follows:

$$r' = No/Ni;$$

where *No* and *Ni* are accumulated over a plurality of frames;

determining a feedback correction factor (B_k) responsive to the value of r'; and,

wherein calculating Qo includes modifying the value of Qo in response to B_k.

11. The method of claim 10 wherein determining B_k includes determining B_k, for each frame, as follows:

$$B_k = r'/r.$$

12. The method of claim 11 wherein calculating Qo includes calculating Qo, for each frame, as follows:

$$Qo = (\alpha_k \cdot Qi)/r \cdot B_k;$$

wherein the value of α_k is updated after every frame.

13. The method of claim 1 further comprising:

accepting a target bit rate ratio (r) for transcoding the video stream equal to the ratio of the target output video stream number of bits per frame (No), to the input video stream number of bits per frame (Ni) as follows:

$$r = No/Ni;$$ and,

wherein encoding the output video stream into a protocol using Qo includes encoding the output video stream into an MPEG-4 video stream using r.

14. In the transcoding of MPEG video streams, a method for adaptive rate control, the method comprising:

accepting frames of an input MPEP-2 encoded video stream;

decoding the video stream;

determining a video stream complexity ratio: of an accumulated complexity in the output video stream, to an accumulated complexity in the input video stream;

for each frame, calculating an output video stream quantization parameter (Q_o) in response to the complexity ratio; and,

encoding the output video stream into an MPEG-4 protocol using Q_o.

15. In the transcoding of video streams, a system for adaptive rate control, the system comprising:

a decoder having an interface to accept frames of an input MPEG encoded video stream, an interface to supply a decoded video stream, and an interface to supply decoding process information;

a transcoder control unit having an interface to accept the decoding process information, the transcoder control unit determining video stream complexity and supplying an output video stream quantization parameter (Q_o) responsive to determined video stream complexity for each frame of the decoded video stream; and,

an encoder having an interface to accept the decoded video, an interface to accept Q_o, and an interface to supply an output video stream encoded into a protocol using Q_o.

16. The system of claim 15 wherein the transcoder control unit has an interface to accept a target bit rate ratio (r) for transcoding the video stream that is equal to the ratio of the target output video stream number of bits per frame (*No*), to the input video stream number of bits per frame (*Ni*) as follows:

$r = No/Ni$; and,

wherein the transcoder control unit calculates *Qo* responsive to the value of r.

17. The system of claim 16 wherein the decoder supplies decoder processing information including an average input video stream quantization factor (*Qi*) for each frame; and,

wherein the transcoder control unit calculates initially calculates *Qo* as follows:

$Qo = Qi/r$.

18. The system of claim 17 wherein the decoder accepts frames of an input MPEG encoded video stream with a plurality of slices; and,

wherein the decoder calculates *Qi* for each frame by averaging the *Qi* values for each slice in a frame.

19. The system of claim 17 wherein the decoder accepts an input MPEG encoded video stream including intra (I), predictive (P), and bi-directionally predictive (B) picture types; and,

wherein the transcoder control unit independently determines the complexities of the I, P, and B picture types in the input video stream, and independently determines the complexities of the I, P, and B picture types in the output video stream.

20. The system of claim 17 wherein the transcoder control unit calculates *Qo* in response to a complexity ratio of: an accumulated complexity in the output video stream, to an accumulated complexity in the input video stream.

21. The system of claim 20 wherein the transcoder control unit calculates an accumulated complexity in the input video stream as the product of *Qi* times *Ni*, accumulated over a plurality of frames, and calculates the accumulated complexity of the output video stream as the product of *Qo* times *No*, accumulated over the plurality of frames.

22. The system of claim 21 wherein the transcoder control unit calculates the complexity ratio (α_k) as follows:

$$\alpha_k = \frac{\sum_{j=0}^{k-1}(Q_{o,j} \cdot N_{o,j})}{\sum_{j=0}^{k-1}(Q_{i,j} \cdot N_{i,j})};$$

wherein j equals the plurality of frames; and,

wherein k is the current frame.

23. The system of claim 22 wherein the transcoder control unit calculates Qo, for each frame, as follows:

$$Qo = (\alpha_k \cdot Qi)/r.$$

24. The system of claim 23 wherein the transcoder control unit determines an actual bit rate ratio (r') for transcoding the video stream as follows:

$$r' = No/Ni;$$

where No and Ni are accumulated over a plurality of frames; and,

wherein the transcoder control unit determines a feedback correction factor (B_k) responsive to the value of r', and modifies the value of Qo in response to B_k.

25. The system of claim 24 wherein the transcoder control unit determines B_k, for each frame, as follows:

$$B_k = r'/r.$$

26. The system of claim 25 wherein the transcoder control unit calculates Qo, for each frame, as follows:

$$Qo = (\alpha_k \cdot Qi)/r \cdot B_k;$$

wherein the value of α_k is updated after every frame.

27. The system of claim 15 wherein the transcoder control unit has an interface to accept a target bit rate ratio (r) for transcoding the video stream equal to the ratio of the target output video stream number of bits per frame (*No*), to the input video stream number of bits per frame (*Ni*) as follows:

r = *No*/*Ni*;

wherein the transcoder control unit calculates *Qo* responsive to the value of r; and,

wherein the encoder encodes the output video stream into an MPEG-4 protocol.